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(19) (CA) **CANADIAN PATENT** (12)

(54) Process for Forming Low-Viscosity Emulsions of Polar Oils in Water

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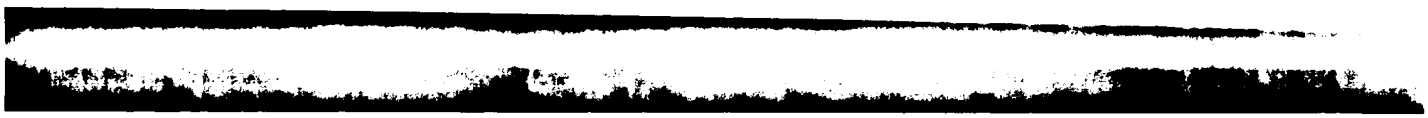

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Abstract of the Disclosure

Low-viscosity oil-in-water emulsions of oils that are at least 50 % by weight monoesters and diesters containing at least 10 carbon atoms and may also contain up to 50% by weight of aliphatic acid triglycerides and/or up to 25% by weight of hydrocarbon oils may be prepared by emulsification with 0.1 to 0.5 part by weight - per part by weight of the oil component - of an emulsifier having an HLB value of 11 to 12 and, preferably, also with 0.1 to 0.5 part by weight - per part by weight of the oil component - of a co-emulsifier of the saturated aliphatic alcohol or aliphatic acid/polyol partial ester type. The emulsion, which contains at least 1 part by weight of water per part by weight of oil component, is prepared at a temperature above the melting point of the mixture of oil component, emulsifier, and co-emulsifier if used, by a process that includes heating the mixed components to a temperature within or above the phase inversion temperature range, subsequently cooling the emulsion to a temperature below the phase inversion temperature range and, optionally, further diluting the emulsion with water.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A process for the preparation of an oil-in-water emulsion which inverts at temperatures below 100°C, of an oil component (A) consisting essentially of:

(A.1) 50 to 100% by weight of mono- or di-ester molecules that contain at least 10 carbon atoms and that correspond to one of the formulae R^1COOR^2, $R^2OOC-R^3-COOR^2$, and $R^1COO-R^3-OOCR^1$, in which each of R^1 and R^2 independently represents a C_{1-22} alkyl group or C_{8-22} alkenyl group and R^3 represents a C_{2-16} alkylene group;

(A.2) up to 50% by weight of aliphatic acid triglycerides of C_{8-22} aliphatic acids; and

(A.3) up to 25% by weight of hydrocarbon molecules,

said process comprising the steps of:

(I) forming, at a temperature sufficiently high that all components are present in liquid phase, an emulsion consisting essentially of:

a selected quantity of component (A);

a quantity of water having a weight at least equal to the selected quantity of component (A); and

(B) about 0.1 to about 0.5 part by weight, per part by weight of component (A), of a primary emulsifier component having an HLB value of 11 to 12 and consisting of molecules selected from the group consisting of

(B.1) adducts of ethylene oxide with C_{16-22} aliphatic alcohols and

(B.2) adducts of ethylene oxide with partial esters between C_{3-6} polyols and C_{14-22} aliphatic acids;

(II) exposing the emulsion formed in step (I) to a temperature within its phase inversion temperature range; and

(III) cooling the emulsion formed in step (II) below its phase inversion temperature range.

2. A process for the preparation of an oil-in-water emulsion which inverts at temperatures below 100°C, of an oil component (A) consisting essentially of:

(A.1) 50 to 100% by weight of mono- or di-ester molecules that contain at least 10 carbon atoms and that correspond to one of the formulae R^1COOR^2, $R^2OOC-R^3-COOR^2$, and $R^1COO-R^3-OOCR^1$, in which each of R^1 and R^2 independently represents a C_{1-22} alkyl group or C_{8-22} alkenyl group and R^3 represents a C_{2-16} alkylene group;

(A.2) up to 50% by weight of aliphatic acid triglycerides of C_{8-22} aliphatic acids; and

(A.3) up to 25% by weight of hydrocarbon molecules,

said process comprising the steps of:

(I) forming, at a temperature sufficiently high that all components are present in liquid phase, an emulsion consisting essentially of:

a selected quantity of component (A);

a quantity of water having a weight at least equal to the selected quantity of component (A);

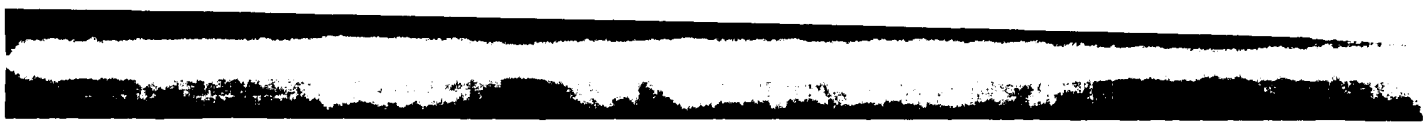
(B) about 0.1 to about 0.5 part by weight, per part by weight of component (A), of a primary emulsifier component having an HLB value of 11 to 12 and consisting essentially of molecules selected from the group consisting of

(B.1) adducts of ethylene oxide with C_{16-22} aliphatic alcohols and

(B.2) adducts of ethylene oxide with partial esters between C_{3-6} polyols and C_{14-22} aliphatic acids; and

(C) from 0.1 to 0.5 part by weight, per part by weight of component (A), of a co-emulsifier component consisting essentially of molecules selected from the group consisting of:

A



(C.1) saturated C_{16-22} aliphatic alcohols; and

(C.2) partial esters of C_{3-6} polyols with saturated C_{14-22} aliphatic acids;

(II) exposing the emusion formed in step (I) to a temperature within its phase inversion temperature range; and

(II) cooling the emulsion formed in step (II) below its phase inversion temperature range.

3. A process according to claim 1, additionally comprising a step (IV) of diluting with water the oil-in-water emulsion formed in step (III).

4. A process according to claim 3, wherein primary emulsifier component (B) consists essentially of molecules that are adducts of 8 to 12 molecules of ethylene oxide with saturated C_{16-22} aliphatic alcohol molecules.

5. A process according to claim 2, wherein primary emulsifier component (B) consists essentially of molecules that are adducts of 8 to 12 molecules of ethylene oxide with saturated C_{16-22} aliphatic alcohol molecules.

6. A process according to claim 1, wherein primary emulsifier component (B) consists essentially of molecules that are adducts of 8 to 12 molecules of ethylene oxide with one saturated C_{16-22} aliphatic alcohol molecule.

7. A process according to claim 2, wherein oil component (A) consists essentially of molecules selected from classes (A.1) and (A.2) only and component (B) consists essentially of molecules that are adducts of 8 to 12 molecules of ethylene oxide with one saturated C_{20-22} aliphatic alcohol molecule.

8. A process according to claim 4, wherein component (A) consists essentially of molecules selected from classes (A.1) and (A.2) only and component (B) consists essentially of molecules that are adducts of 8 to 12 molecules of ethylene oxide with one saturated C_{20-22} aliphatic alcohol molecule.

9. A process according to claim 3, wherein component (A) consists essentially of molecules selected from classes (A.1) and (A.2) only and component (B) consists essentially of molecules that are adducts of 8 to 12 molecules of ethylene oxide with one saturated C_{20-22} aliphatic alcohol molecule.

10. A process according to claim 1, wherein component (A) consists essentially of molecules selected from classes (A.1) and (A.2) only and component (B) consists essentially of molecules that are adducts of 8 to 12 molecules of ethylene oxide with one saturated C_{20-22} aliphatic alcohol molecule.

11. A process according to claim 9, wherein component (C) consists essentially of molecules selected from the group consisting of cetyl alcohol, stearyl alcohol, and monoesters of glycerol, sorbitan, and trimethylolpropane with saturated C_{14-22} aliphatic acids.

12. A process according to claim 8, wherein component (C) consists essentially of molecules selected from the group consisting of cetyl alcohol, stearyl alcohol, and monoesters of glycerol, sorbitan, and trimethylolpropane with saturated C_{14-22} aliphatic acids.

13. A process according to claim 7, wherein component (C) consists essentially of molecules selected from the group consisting of cetyl alcohol, stearyl alcohol, and monoesters of glycerol, sorbitan, and trimethylolpropane with saturated C_{14-22} aliphatic acids.

14. A process according to claim 2, wherein component (C) consists essentially of molecules selected from the group consisting of cetyl alcohol, stearyl alcohol, and monoesters of glycerol, sorbitan, and trimethylolpropane with saturated C_{14-22} aliphatic acids.

15. A process according to claim 4, wherein component (C) consists essentially of molecules selected from the group consisting of cetyl alcohol, stearyl alcohol, and monoesters of glycerol, sorbitan, and trimethylolpropane with saturated C_{14-22} aliphatic acids.

16. A process according to claim 3, wherein component (C) consists essentially of molecules selected from the group consisting of cetyl alcohol, stearyl alcohol, and monoesters of glycerol, sorbitan, and trimethylolpropane with saturated C_{14-22} aliphatic acids.

17. A process according to claim 16, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

18. A process according to claim 15, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

19. A process according to claim 14, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

20. A process according to claim 13, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

21. A process according to claim 12, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

22. A process according to claim 11, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

23. A process according to claim 10, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

24. A process according to claim 9, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

25. A process according to claim 8, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

26. A process according to claim 7, wherein the oil component (A), the emulsifier (B) and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

27. A process according to claim 5, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

28. A process according to claim 4, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

29. A process according to claim 3, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

30. A process according to claim 2, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.1 - 0.3 : 0.1 - 0.3.

31. A process according to claim 30, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

32. A process according to claim 29, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

33. A process according to claim 28, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

34. A process according to claim 27, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

35. A process according to claim 26, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

36. A process according to claim 25, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

37. A process according to claim 24, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

38. A process according to claim 23, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

39. A process according to claim 22, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

40. A process according to claim 21, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

41. A process according to claim 20, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

42. A process according to claim 19, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

43. A process according to claim 18, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.

44. A process according to claim 17, wherein the oil component (A), the emulsifier (B), and the co-emulsifier (C) are used in a ratio by weight of A to B to C of 1 : 0.2 : 0.15.